Pineapple Cannery Waste and Its Insect Problems

BY J. F. ILLINGWORTH

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Refuse from the pineapple canneries is rich in organic matter. The solid materials are mainly skins and cores. Then, too, the wash water carries away quantities of fruit fiber, and some sugar from the juice. Hence, altogether, such waste offers an ideal breeding ground for insects.

A few years ago, when it was the practice to dump all the refuse in temporary piles near the cannery, a serious insect problem developed. Souring beetles (Nitidulidae) developed in such hordes that radical changes in factory construction became necessary. These insects were troublesome by getting into the open tins of fruit. To cope with the problem, glass partitions were put in to try to keep the beetles from entering the canning room. Finally, however, the larger factories attacked the problem at its source by installing special machinery for drying the refuse. Later it was found that this so-called waste product was rich in food value and was relished by cattle and other stock. Now, this dried material is put up in large bags and sold extensively as "Pineapple Bran."

The smaller canneries do not have sufficient refuse to make the installation of drying machinery practical. Hence the solid material must be carted to some distance, and is usually dumped into a gully or onto waste land. Even this method of disposal, however, does not fully eliminate the trouble from souring beetles in the cannery, as I shall discuss later in this paper.

I was called to one cannery where a scourge of house flies threatened to drive them out of business. These pests were present in countless numbers everywhere in the building, on the floors, on the trimming tables, and on the walls. They troubled the workers by constantly running over their hands and faces, feeding upon the sweet pineapple juice. Hence much efficiency was lost, in an everlasting effort to chase off the flies. Worse, however, was the fact that the disgusting insects were contaminating the peeled fruit on the tables, even, occasionally, drowning in the hot syrup of the cans.

This outbreak was most remarkable, since house flies, under ordinary conditions, are effectively held in check in Hawaii by natural enemies, chief among which is the predaceous, subtropical ant, *Pheidole megacephala* (Fab.).

Investigating the problem with the cannery officials, who gave me most cordial coöperation, I noted at once the reason for the outbreak. The wash water from the cannery, containing considerable fruit fiber, etc., was run off onto low, sandy ground, where it formed considerable ponds. Fermentation developed a heavy scum, which collected here and there in sort of islands, floating on the surface. In this scum was a writhing mass of maggots; when wind chanced to push a floating mass to shore, the maggots moved as an army onto the sand, where they pupated, in a few days to emerge as flies and enter the cannery.

Every effort had been made by the superintendent of the cannery to allay the nuisance, without avail. Tons of chloride of lime had been spread around the borders of the ponds, in an attempt to hinder the progress of the migrating maggots; also many barrels of crude oil were poured into the water and onto the shore, but these measures seemed to have little effect upon the rapidly increasing numbers of the pest. The maggots crawled, even through the oil, with no apparent injury, and entered the sand. Not to be outdone, I was told, they piled brush over the surface of the pond, sprayed it with crude oil, and set the whole thing on fire. Yet only the maggots on the surface were affected, and migrations of millions continued, wherever the scum islands touched the shore. At the time of my visit, the scum and muck from the sediment of the ponds were being collected by a gang of men, and buried in deep pits dug in the sand, at considerable expense. The ineffectiveness of this measure, I pointed out, for, as Dr. Stiles demonstrated in Washington, house flies are able to emerge even when buried under six feet of sand.

To abate the nuisance a barrel of arsenious acid (white arsenic) was purchased. This chemical was dissolved with caustic soda, using the formula developed at Olaa plantation for weed control: 50 pounds caustic soda, 270 pounds arsenic, and 100 gallons water. As soon as the arsenic became soluble the liquid was run very slowly into the flume carrying the waste waters

from the cannery. After a few days the effect upon the population of the ponds was very satisfactory. No maggots could be seen migrating and none could be found alive in the scum. The whole treatment required less than one-half of the barrel of arsenic.

To rid the vicinity of the adult insects we made use of Maxwell Lefroy's experiments, whereby he cleared the army camps of a scourge of flies. Bags were wet in a sweetened solution of the soluble arsenic and hung up where the flies could settle on them. Inside the cannery it was not safe to use poisons, so traps were constructed, of the well-known cone type. These were very effective. Once new hordes from the ponds ceased, the situation quickly improved, and the buildings were practically free from the pest.

The souring beetles, referred to above, are a more troublesome pest to combat. I have long considered them a major problem in the field, but it is the cannery phases that I shall discuss here. Even our best equipped institutions suffer, at times, from the entrance of hordes of these insects.

The beetles are strongly attracted to overripe fruit. In one instance I was called for consultation, because the trimmers found so many of the larval beetles coming onto the tables with the peeled fruit. This was during the winter season when pickings were far apart, and I discovered, by a study of the problems in the field, that now and then an overripe, soft fruit was placed in the lug boxes with the perfect specimens. During transit from the field to the cannery these soft fruits became more or less crushed, and the beetle larvae crawled all over the adjoining good fruits. In this way some of them were carried along onto the tables. The management was paying the girls five cents each for throwing out perfect fruits on which beetle larvae were found. From the pile discarded I estimated that the loss was considerable. Elimination and destruction of the overripe, infested fruits in the field, instead of mixing them with the good fruit for the cannery was recommended.

In the cannery the beetles show a very strong light reaction. They are easily attracted away from the tables, cookers, etc., to windows with bright sunlight. I found that fruit shipped from

the field in closed box cars had clouds of beetles emerge when the doors were opened at the cannery platform. In contrast with this situation, few beetles were noticeable about the boxes of fruit on open cars. During transit most of the pests fly and are blown away from the open crates. Hence, I concluded, the situation would be considerably relieved by openings in the box cars—the beetles flying to the light are blown away.

The wind relation is another consideration in combating these insects in the cannery. Factories with receiving platforms to the windward are considerably troubled with the pest, while just the reverse is true where the fruit is received on the leeward side. In this latter case, the beetles when disturbed take wing and are wafted away from the cannery by the prevailing wind. This is particularly noticeable in one of the canneries favorably situated in Honolulu.

That the souring beetles travel far on the wing is another factor that must be taken into consideration in dumping cannery waste. They are strong fliers with the wind, as I found in one instance. In this case it was difficult to account for the great numbers of beetles entering a cannery with no breeding material in the immediate vicinity. I finally traced the source to a dump of pineapple refuse from another cannery more than a mile to the windward. Hence, we may conclude that dumping the refuse is a poor policy under any consideration, for the hordes of insects produced soon spread to fields of growing plants, curtailing production, and eventually, as we have seen, many travel back to the cannery with the ripe fruit. Therefore it would appear that best results for the industry can only be secured by the strictest sanitary field practice. It is there that the beetles breed, and clean culture will go far toward removing the trouble from these insects in the cannery.

Notes on Some Bugs Associated with Pineapples in Hawaii

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During our study of yellow spot disease of pineapples, various Hemiptera came in for investigation. I wish here to record briefly notes on three species of Heteroptera.